specimens from Maharashtra and Gujarat revealed that this character is highly variable. In these specimens three, quite unequal bristles were found. These are linear-lanceolate, acute at the apex and antrorsely scabrous (retrorsely scabrous in most Indian species) on the upper half. The longest bristle varies from much smaller than to equaling the length of the nut. It is somewhat broad and glume-like, membranous, 0.5 - 2 mm long. The smallest bristle is usually minute, scale-like, upto 0.5 mm long, and is found opposite to the broadest face of the nut. In some cases only a single, rudimentary, scale-like bristle was found. Also, there are specimens in which perianth bristles are absent.

Another interesting observation is that whenever well developed bristles are present the nut is obovoid to broadly obovoid, but if the bristles are absent the nut is ellipsoid. An intermediate stage between ellipsoid and obovoid is found when the bristle is very small or rudimentary.

Considering the highly variable nature of this character, the possibility of proposing a new taxon even at infraspecific level for the plants with perianth bristles was not considered, because even on a single specimen the nuts were found to be with or without bristles. This abnormal behaviour is recorded, especially for taxonomists, because the perianth bristle is considered an important character in the family Cyperaceae.

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40. LABORATORY EVALUATION OF NATURAL RESISTANCE OF BAMBOOS TO TERMITES

Natural resistance of timbers to insects and other biological agencies is attributed to physical and chemical properties of the wood (Sandermann and Dietrichs, 1967 and Sen-Sarma *et al.*, 1975). Bamboo is a versatile natural forest resource, which is known to play a very important role in the economy particularly of countries lying in the southeast Asian-Pacific region.

Natural resistance of felled and converted wood, to insects and other biological agencies, is attributed to physical and chemical characteristics of timbers. Bamboos though endowed with a hard and highly refractive outer rind, unlike timbers, lack chemical characteristics which impart resistance of high category.

Notwithstanding its versatility and high utility value, authentic data on the natural resistance in bamboos is lacking. Except for the pioneering work of Mishra and Rana (1992), there is no data on the assessment of natural resistance of bamboos to insects. In this paper, results of laboratory evaluation of comparative natural termite resistance of 13 species of bamboos against the test termite *Microcerotermes beesoni* Snyder are presented.

We tested material from 13 species of bamboos growing within the New Forest campus of Forest Research Institute, Dehra Dun. The samples were taken at 50 cm, or more above the ground. The test blocks (2.0 x 2.0 x 1.0 cm^3 size) were prepared from the internodal portion of these samples and oven dried at 85°C after smoothening the cut surface. Since uniform size of the test blocks could not be obtained due to varying thickness of the wall, the percent weight-loss in test blocks was calculated on the basis of weight and total area of test block.

The samples were exposed to the termites, *Microcerotermes beesoni* Snyder following the standard procedure developed at this Institute

(FRI). Classification of bamboos into various categories was done as for timber by Sen-Sarma et al., 1975).

Percent wt. loss	Resistance class
0 - 6	Very resistant (Class I)
7 - 16	Resistant (Class II)
17 - 30	Moderately resistant (Class III)
31 - 50	Poorly resistant (Class IV +)
51 - and above	Perishable (Class IV -)

The results are presented in Table 1. Among the various species of bamboos tested, maximum damage was observed in *Bambusa tulda* (wt. loss 67.31%) and minimum was recorded in *B. nutans* (23.40%), closely followed by *Dendrocalamus strictus* (wt. loss 25.63%), *B. balcooa* (27.42%), *D. giganteus* (28.66%) and *Ochlandra travancorica* (29.82%). The termite resistance quality of these species is comparable specifically to the heartwood of some of the moderately resistant and economically important primary timber species. *e.g. Anogeissus latifolia, Garuga pinnata, Shorea robusta,* etc. The termite resistance of *D. calostachyus. B. vulgaris* f. *waminii, Oxytenanthera albociliata* and *D. membranaceus* is similarly comparable to timber species such as *Acrocarpus fraxinifolius, Pterospermum acerifolium, Quercus leucotrichophora,* etc.

The outer rind of bamboo seems to be highly resistant and refractive in nature, as the timber damage in most of the test samples had taken place in the cut end portion and in some cases through the inner layer. The chemical analysis of various portions of bamboo reveals occurrence of a high percentage of ash and silica in the outer rind (Semana *et al.* 1967 and Espiloy, 1983) which perhaps is responsible for its natural durability as well as strength (Sanyal, *et al.*, 1988).

Similarly, the destructured reconstituted boards from bamboo (*Dendrocalamus strictus*), using phenol formaldehyde adhesive, is highly resistant to termites under laboratory conditions and is comparable to some of the more durable timber species such as *Acacia catechu, Cedrus deodara, Dalbergia latifolia* and *Tectona grandis.*

Notwithstanding some of the moderately resistant bamboo species the untreated bamboos, in general, are destroyed in a short span of time when exposed to actual field conditions. The causes are found in the chemical constituents and felling period of various species. The presence

TABLE 1

NATURAL TERMITE RESISTANCE OF BAMBOOS (MEAN OF 4-7 SAMPLES)

	Name of species	Thickness (cm)	Percent weight loss		Resistant class
			Range	Mean	
	1	2	3	4	5
1.	*Bambusa balcooa* Roxb.	1.15	0.99-63.27	27.42	III
2.	*B. nutans* Wall.	0.58	2.04-38.74	23.40	III
3.	*B. tulda* Roxb.	1.65	5.37-100.00	67.31	IV-
4.	*B. vulgaris* var. *striata* Holturn	1.02	11.64-100.00	58.25	IV-
5.	*B. vulgaris* f. *waminii* (Brandis)	1.63	6.55-81.20	36.05	IV+
6.	*Dendrocalamus calostachyus* Kurz.	1.15	3.21-61.22	31.32	IV+
7.	*D. giganteus* Munro	1.70	2.17-62.55	28.66	III
8.	*D. hamiltonii* Nees & Arn.	1.50	7.23-92.10	59.74	IV-
9.	*D. longispathus* Kurz.	1.65	8.40-96.51	60.07	IV-
10.	*D. membranaceus* Munro	1.45	8.11-100.00	48.58	IV+
11.	*D. strictus* Nees	1.00	2.98-73.52	25.63	III
12.	*Ochlandra travancorica* Benth.	1.45	6.28-57.03	29.82	III
13.	*Oxytenanthera albociliata* Munro	1.00	2.98-89.52	48.37	IV+

of higher quantity of carbohydrates, especially the starch content and soluble sugars makes the bamboo relatively more susceptible to insects/termites (Beeson, 1941; Roonwal and Thapa, 1960 and Suthoni, 1988). In addition, the bamboos under field conditions are infected by a large number of fungi, thus making them highly susceptible to insect attack (French, 1978; Shukla *et al.*, 1978 and Tyagi *et al.*, 1984).

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41. NEW DISTRIBUTIONAL RECORDS OF PLANTS FROM ORISSA

In the course of our studies on flora of Orissa, a number of plants were collected from different parts of the state. 5 angiospermic taxa collected recently, were identified with the help of relevant taxonomic literature and consultation of authentic herbarium specimens at Central National Herbarium, Howrah (CNH) as *Aristolochia tagala* Cham., *Sauromatum venosum* (Aiton) Kunth., *Spermacoce mauritiana* Osea Gideon ex Verdc., *S. latifolia* Aubl. and *Spilanthes iabadicensis* Moore. Scrutiny of literature revealed that these species have not been reported from Orissa. Updated nomenclature, phenology, ecology, citation of specimens studied and useful notes on them are presented below. All the materials have been deposited in the Herbarium of Regional Plant Resource Centre, Bhubaneswar.

Aristolochia tagala Cham. Linnaea 7: 207.t.5.f.3.1832; Haines, Bot. Bihar & Orissa 786.1924. *A. acuminata* Roxb. *Fl. Ind.* 3:489.1832, non Lam. 1783. *A. roxburghiana* Klotzsch, *Monatsber. Deutsch. Akad. Wiss.* Berlin 596.1859; Hook.f., *Fl. Brit. India* 5:75.1886 (Aristolochiaceae)

Fl. & Fr.: Throughout the year.

Ecology: Occasional, climbing on trees and shrubs in semi-evergreen forests.